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IMPORTANCE OF QUALITY IN THE UTILIZATION OF FORAGE

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The importance of including good-quality forage in the ration of dairy cattle has received considerable attention by research workers during the past 15 years. Such research has received added impetus because of the soil-conservation program and the increasing acreage of grassland crops.

Economics

There are several reasons why the dairy farmer should be interested in good forage -- especially good hay and silage -- for his dairy herd. Perhaps a review of these reasons will give some insight into the importance of feeding good-quality forage to dairy cattle. It is also noteworthy that during the past 10 years we have learned how to preserve more of the nutrients in these feeds with a resulting increase in quality. Greater preservation of the valuable nutrients in forage crops benefits the dairy cow nutritionally and benefits the dairy farmer economically.

One of the most effective ways to appeal to the dairyman is to talk dollars and cents, and one of the most important reasons why the dairyman should be interested in good hay and silage is that it costs less to provide winter feed from these sources than from grains. This fact is brought out by the following figures, which were collected recently at Beltsville by the Dairy Husbandry Research Branch in a crop rotation study involving pasture.

Table 1 - Cost of 100 lbs. of Total Digestible Nutrients

Orchard grass-ladino pasture in rotation with crops	$0.69
Bluegrass-white clover pasture well managed	0.71
Mixed hay	1.10
Corn silage	1.35
Wheat	2.56

While these specific cost figures may not apply to all States, most data of this nature show that pasture is the cheapest source of nutrients,

followed in order by preserved forages.

Minerals and vitamins in good quality forage

Another reason why the dairyman should be interested in good hay and silage is that these feeds are the best sources of the vitamins and minerals needed by dairy cattle. For instance, one of the vitamins necessary for health and reproduction is vitamin A, or its precursor carotene. Experiments have shown that cattle cannot survive for long on grains alone, even on the best concocted grain ration, unless it is supplemented with vitamin A and minerals. However, cattle can survive, produce milk liberally, and reproduce on good-quality hay as the sole ration for the lifetime of the cow.

Vitamin A deficiency in dairy cattle probably does not occur very often under practical farm conditions. The deficiency has been observed when the dairyman feeds too much grain in proportion to forage in an attempt to get rapid growth; in drought years when pastures are short and of poor quality; and when poor-quality forage or a limited quantity of forage is fed over a long period of time. A brown, late-cut timothy hay, a 2-year old hay, or No. 3 quality hay falls in the vitamin-A deficient class of poor-quality forages.

The relative effect on calving of feeding cows either good- or poor-quality hay as the sole roughage over a long period of time was determined at Beltsville several years ago. The results are shown in the following table:

Table 2 - Effect on calving when cows were fed No. 1 alfalfa hay or No. 3 timothy hay as the sole roughage

Cow	Years on ration before calving number	Days cow calved before due number	Remarks
			Fed No. 1 Alfalfa hay
N-403	1.83	10	Calf normal except for small size.
	3.17	7	Calf normal.
N-102	1.92	2	Calf normal.
N-202	1.41	7	Calf normal.
N-213	1.83	4	Calf normal.
			Fed No. 3 Timothy hay
	.75	18	Calf born dead; not examined for B. abortus.
N-103	2.08	25	Calf very weak; died after 9 days.
	3.33	154	Calf born dead; no B. abortus found.
N-200	.75	20	Calf born dead; not examined for B. abortus.
N-301	1.00	17	Calf weak and blind; killed after 1 day.
	2.25	13	Calf weak and blind; killed after 2 days.
N-401	1.33	9	Calf weak and blind; killed after 2 months.
	2.67	23	Calf born dead; no B. abortus found.

The table shows that the cows that were fed poor-quality hay (No. 3 timothy) dropped weak and blind or dead calves. This unfavorable effect on the calves was due to a deficiency of vitamin A or carotene in the hay.

Whether hay or silage has this essential carotene "value" depends on the quality. This is especially true of hay. The average carotene content of various U. S. grades of hay is shown in the following tabulation:

Table 3 - Relation of grade of hay to its carotene content

Kind of feed	Carotene content	
	Average	Range
	Mcg./g.	Mcg./g.
Alfalfa hay:		
Grade U. S. No. 1 in color	43	19-121
Grade U. S. No. 2 in color	15	12- 20
Grade U. S. No. 3 in color	4	1- 11
Timothy hay:		
Grade U. S. No. 1 in color	21	8- 36
Grade U. S. No. 2 in color	9	8- 11
Grade U. S. No. 3 in color	5	1- 12
Corn stover (dry)	4	2- 6
Corn silage	15	1- 40

It will be seen that the carotene content of hay varies with the quality or grade of the hay. The quality or grade of the hay is an expression largely of its leafiness and color. For instance, No. 1 alfalfa must contain at least 40 percent leaf; No. 2, 30 percent leaf; and No. 3, only 20 percent leaf. The quality of the hay is also affected by stage of maturity at time of cutting, method of preservation, weather conditions, and many other factors.

In order to translate the carotene content of the various grades of hay into the pounds necessary to furnish twice the minimal carotene needs of dairy cows, Table 4 was set up.

It will be seen that it is not possible for a dairy cow to consume enough No. 3 hay to meet her carotene requirements, but she needs only from 5 to 11 pounds of No. 1 hay to obtain the necessary carotene. Most of the hay produced on the average farm falls into the No. 2 or No. 3 grade. It is difficult to produce No. 1 field-cured hay, especially in the humid areas where it does not dry rapidly in the field. It seems obvious that, in order to maintain excellent health and reproduction in a herd of cattle, the dairyman should feed good-quality hay, grass silage or corn silage.

Table 4 - Quantity of hay of various grades required to furnish twice the minimal daily carotene needs of a dairy cow

Grade of hay	Carotene content	Daily quantity of hay for			
		800-lb. cow	1,000-lb. cow	1,200-lb. cow	1,400-lb. cow
	Mcg./g.	Pounds	Pounds	Pounds	Pounds
	2	106	141	159	185
No. 3	4	53	70	80	97
	6	35	44	53	62
	12	17	22	26	31
No. 2	16	13	17	20	24
	20	11	14	16	19
	24	9	11	13	16
No. 1	30	7	9	11	12
	50	4	5	6	7
Corn silage	15	14	18	21	25
Grass silage	50	4	5	6	7

In order to utilize grassland crops for winter feeding they must be properly harvested and preserved in order to have high quality forage. As much as 75 to 80 percent of the nutrients a cow receives during the lactation period should come from forages, since forages are the cheapest source of nutrients on the farm. Yet cows will not begin to consume this proportion of forage unless it is of good quality. The importance of this factor of quality in hay is shown in Table 5.

Table 5 - Effect of quality of hay on animal growth and yield of milk

Grade of hay fed	Leafiness	Protein	Fiber	Dry matter consumed per day	Gain in weight per day	Daily milk yield
	%	%	%	pounds	pounds	pounds
Effect on growth:						
U.S. No. 1 alfalfa	47.8	20.3	27.5	16.5	1.51	----
U.S. No. 3 alfalfa	18.7	13.8	38.8	14.0	1.15	----
Effect on milk yield:						
U.S. No. 1 alfalfa	50	18.6	21.2	36.2	----	42.6
U.S. No. 3 alfalfa	29	14.6	32.4	28.2	----	36.7

U. S. No. 1 hay is high in color and leaf whereas U. S. No. 3 hay is low in leaf and color. Only about 10 to 15 percent of the hay produced in the dairy areas would be classed as No. 1 hay. The information I have presented shows definitely that both cows and heifers will consume more hay if it is of good quality. The consumption of large quantities of good forage is a prerequisite to the economical production of milk, which is a value the dairyman cannot overlook.

Extensive studies by the Dairy Husbandry Research Branch have shown that good-quality hay can be produced by barn drying the hay. While good-quality field-cured hay can be produced occasionally, less chance can be taken with the weather if a barn drier is available. In the long run less loss of dry matter and a better quality of hay will be obtained by barn drying.

Moisture content of silage and consumption

More and more dairymen are now turning to grass silage because of the larger acreage of hay crops, and in some areas there is a shift from corn silage to grass silage. Unlike for hay, we do not have good standards of quality for grass silage. However, some recent data obtained by the Dairy Husbandry Research Branch indicate that moisture content of silage has considerable to do with the quantity of silage consumed by the dairy cow. Possibly moisture content of silage should be considered in judging its quality. The data referred to are shown in Table 6.

Table 6 - Relation between the moisture content of silage and the amount of silage dry matter consumed by dairy cows 1/

Crop harvested	Moisture content of silage	Dry matter eaten per 100 lbs. of live weight per day
	percent	pounds
Orchard grass:		
First cutting (boot stage)		
Fresh green	79.7	1.36
Wilted	66.9	2.00
Second cutting (early hay stage)		
Fresh green	71.8	2.08
Fresh green + 5% dry grain	69.7	2.21
Wilted	59.5	2.11
Alfalfa:		
First cutting (1/10 to 1/4 bloom)		
Fresh green	77.9	1.23
Wilted	72.7	1.94
Wilted	65.6	2.34
Half-dry 2/	45.7	2.52
Soybeans:		
First pods forming (dry season)		
Fresh green	74.1	1.52
Fresh green + 10% dry grain	69.9	2.19
Wilted	58.1	1.85

1/ From Beltsville experiments in 1950-52.

2/ In gas-tight silo; no mold.

It should also be remembered that the feeding value of a pound of low moisture grass silage may be almost twice as great as a pound of high moisture silage because of the extra water. The cow pays off at the milk pail in terms of the amount of feed dry matter she consumes and not in terms of total pounds of feed consumed. These comments do not infer that high moisture silage is not a good feed if properly handled. I merely wish to point out some limitations.

The milk producing qualities of grass silage is no better than the crop which goes into the silo even though it has become better disguised than if the same crop were made into hay. In assessing the feeding value of grass silage the farmer should picture the same crop as it would appear as hay.

Poor quality forages

Several experiment stations have been conducting some excellent studies on the effect of the quality of forage on its digestibility. These studies have shown that the nutrients in poor-quality forage may not be digested out of the forage to the full extent. Experimentally, this lower digestibility has been corrected by adding the ash of good-quality forage.

Except under extenuating circumstances, in my opinion, poor quality forages have no place in the ration of producing dairy cattle for economical milk production. These feeds are deficient in energy, minerals and vitamins and must be supplemented with high energy, high cost feeds in order to maintain a high state of milk production. The modern dairy farmer has it within his power today to produce high quality forages for his winter feed supply, and his thoughts should be guided in this direction and not how to use poor quality forages except under abnormal conditions.

Production of quality forages

The following statement may seem rather startling because it would not generally hold under most conditions of production: "It costs more to produce a ton of hay of poor quality than a ton of hay of good quality." Actual data collected at Beltsville on hay-harvesting experiments bear out this statement, as shown in Table 7. This is because poor quality is often the result of harvesting hay during inclement weather conditions, so that there are resulting field losses and, therefore, less tonnage is produced per acre. More labor and a greater use of machinery - especially the side-delivery rake -- are necessary per ton of hay. These factors increase the cost of producing a ton of hay very materially, and make a ton of poor hay cost more than a ton of good hay. Of course, if you were to sell a ton of poor hay you would not get paid for the extra cost of production, nor will the cow pay for it when such hay is fed to her.

Table 7 - Labor, power, and machinery requirements of harvesting and storing alfalfa at Beltsville, Md., 1945-47 1/
(Hours per ton of dry matter preserved)

Items compared	Alfalfa harvested and stored as			
	Wilted silage	Barn-dried hay 2/	Field-cured hay	Rain-damaged field-cured hay
Labor	4.87	4.59	4.33	6.30
Tractor	1.35	1.32	1.57	3.38
Mower	.47	.47	.53	.65
Rake	.35	.44	.84	2.46
Loader	.48	.41	.44	.66
Truck	1.66	1.30	1.99	1.84
Silo filler	.54	--	--	--
Hay hoist	--	.41	.30	.28

1/ Figures for wilted silage, barn-dried hay, and field-cured hay are averages for 1945 and 1946; figures for rain-damaged field-cured hay are for 1947.
2/ Blower fan operation; electricity and heat required in addition.

Comparative feeding value of hay harvested as silage, barn-dried hay, and field-cured hay

There are three practical procedures available for harvesting hay crops. These are: (1) Harvesting the crop as silage, (2) as barn-dried hay, and (3) as field-cured hay.

Compared with field-cured alfalfa hay that was not rain damaged and that was of excellent quality, and taking into consideration differences in field losses and milk production, experiments at Beltsville show that alfalfa from the same field that was barn-dried without heat produced 3 percent more milk per acre, while alfalfa silage produced 5 percent more milk per acre. Compared with field-cured hay that was rain damaged, alfalfa from the same field that was barn-dried without heat produced 28 percent more milk per acre, while alfalfa silage produced 31 percent more milk per acre. In the dairy regions where humid conditions prevail during the hay-curing season, it is quite likely that the averages for comparison would lie some place between the two extremes just noted. Thus, on the average from year to year, one might expect about 12 percent more milk per acre when the hay crop is barn-dried without heat and about 15 percent more milk per acre when it is harvested as silage. Our experimental results, of course, were obtained with alfalfa as the experimental crop and might not apply where the crop is principally grass.

One reason for the better results with silage is that the freshly cut crop is exposed to the chances of weather damage for shorter periods than when it is field-cured or barn-dried. For instance, in these studies the alfalfa that was harvested as silage by the wilting procedure was, on the

average, in the silo within 6.5 hours after cutting, whereas the crop for barn-dried hay was exposed to the weather for an average of 29.4 hours, and the field-cured hay was exposed for 53.6 hours after cutting. Also, field-cured hay should contain no more than 25 percent of moisture when stored. Legume hay handled at this low moisture content loses a considerable amount of leaves. When hay is barn-dried it usually contains about 40 percent of moisture, and when it is made into silage it contains from 60 to 75 percent. At these moisture contents, there is much less leaf shattering during the field operations.

The effect on milk production of feeding alfalfa preserved by the different methods is shown in Tables 8 and 9.

In 1945-46, there was little difference in the feeding value of the crops harvested by the three different methods (Table 8). The field-cured hay was of good quality and produced as much milk as the barn-dried hay and wilted silage, even though the field-cured hay had lost somewhat more nutrients during the curing process. In 1947, when rain-damaged field-cured hay was included in the comparison, the cows on wilted silage and barn-dried hay produced more milk than those on the field-cured hay, as measured by the average daily milk production and the 30-day decline in production (Table 9).

Table 8 - Feeding value of forages produced in 3-way forage harvest, Beltsville, Md., 1945-46 1/

		Wilted silage ration	Barn-dried hay ration	Field-cured hay ration
Milk production:				
Per cow daily	pounds	34.2	33.6	34.0
30-day decline	percent	5.8	7.8	6.6
Liveweight:				
Average per cow	pounds	1,128	1,112	1,121
Gain per day	pounds	.37	.01	.21
Dry matter consumed per cow daily:				
Alfalfa	pounds	17.7	17.6	17.7
Corn silage	pounds	4.7	4.7	4.8
Grain	pounds	8.9	9.1	9.1
Total	pounds	31.3	31.4	31.6

1/ Average of two double reversal feeding trials.

Table 9 - Feeding value of forages produced in 3-way forage harvest, Beltsville, Md., 1947

		Wilted silage ration	Barn-dried hay ration	Rain-damaged field-cured hay ration 1/
Milk production:				
Per cow daily	pounds	37.1	2/ 36.2	35.2
30-day decline	percent	7.7	8.8	13.6
Liveweight:				
Average per cow	pounds	1,178	1,166	1,152
Loss per day	pounds	-.08	-.15	-.19
Dry matter consumed per cow daily:				
Alfalfa	pounds	15.3	15.0	1/14.3
Corn silage	pounds	6.9	6.8	6.6
Grain	pounds	9.6	9.3	9.3
Total	pounds	31.8	31.1	30.2

1/ Field-cured hay unpalatable.
2/ Initial rate of milk production 1 pound less than on other two rations.

These experiments indicate that grass silage and barn-dried hay are equal to good quality field-cured hay in feeding value for milk production. Where the field-cured hay is poor in quality, as often occurs due to poor curing conditions, grass silage and barn-dried hay are superior to field-cured hay.

Comparative consumption of forage harvested as hay or as silage

During the past 10 years there has been considerable discussion by scientists and practical dairymen concerning the relative quantities of dry matter that cows will consume in the form of hay or grass silage.

In an experiment at the Montana field station, the Bureau of Dairy Industry fed one group of four Holstein cows grass hay as the sole ration. The hay was cut at an immature stage from an irrigated area. A similar crop of grass, put up as silage with slight wilting, was fed to a similar group of three cows. The average dry matter content of the silage was 33.3 percent. In both cases, somewhat more hay or silage was fed than was consumed so as to obtain a proper measure of the cows' appetites. The relative data on consumption of the two forages are shown in Table 10.

The results show that cows fed the immature cut hay as the sole ration consumed somewhat more dry matter in the form of hay than the cows fed the grass silage made from a comparable crop. However, it is interesting to note the large quantities of grass silage consumed per day. One cow consumed 123 pounds of grass silage daily in her third month of lactation.

Table 10 - Average daily consumption of hay or grass silage (fresh basis and dry matter basis) and the percentage of required nutrients consumed, by months in lactation.

Months in lactation	Hay or grass silage consumed				Percentage of required nutrients consumed	
	Fresh basis		Dry basis			
	Hay	Silage	Hay	Silage	Hay	Silage
	pounds	pounds	pounds	pounds	percent	percent
1	34.9	82.8	31.9	27.6	81.5	82.2
2	40.9	104.6	37.4	34.8	96.9	102.1
3	41.3	95.0	37.7	31.6	105.1	97.3
4	44.2	100.5	40.4	33.5	118.7	106.4
5	47.2	103.4	43.1	34.4	125.9	112.4
6	45.5	101.6	41.6	34.2	124.8	107.9
7	44.4	102.8	40.8	34.4	125.8	113.9
8	44.4	86.5	40.6	32.0	129.6	107.3
9	43.1	92.1	39.4	33.2	123.3	114.7
10	45.2	92.6	41.3	30.3	134.8	112.1
11	43.3	88.7	39.6	29.6	134.7	119.5
12	39.4	102.6	36.0	34.2	141.5	132.6

Dairymen agree that cows on an all-grass silage ration have a craving for some other form of roughage. Likewise, cows that receive only alfalfa hay or timothy hay as the sole roughage crave some other form of roughage. In practice it would seem wise to feed some hay along with grass silage as roughage. This fits in well with the harvesting program, since the best practice is to put the first crop of forage up as silage and to make the second and third crops into field-cured hay.

Grass silage and health

Wherever the feeding of grass silage is discussed, the question always arises concerning the health of cows fed grass silage as the sole roughage, along with grain. At the Washington station, 10 cows kept on grass silage alone for 3 successive years during the winter and on pasture during the grazing season maintained excellent health. At Beltsville, we have kept milking cows on alfalfa silage as the sole source of forage. The cows stayed on feed, milked well, and retained a sleek hair coat. We have noted no adverse effect on the reproductive processes, and no reports of such effects have come to my attention from dairymen who have fed their cows largely silage. Since grass silage generally contains more of the nutrients of the original crop than average hay, one would naturally expect less difficulty, if good nutrition is a factor in maintenance of the normal reproductive processes.

Raising dairy heifers on good-quality hay

At Beltsville, we have been interested in the possibility of decreasing the cost of raising herd replacements by taking advantage of the use of high-quality hay. We have raised more than 50 heifers on minimal quantities of milk and grain by using good-quality forages. No milk was fed after 60 days of age and no grain after about 9 to 10 months of age. Partial results of this experiment are shown in Table 11. Similar related work has been reported from the Ohio station.

The results show that it is possible to obtain normal growth in dairy heifers with a minimal amount of grain if they are fed good-quality hay. Poor-quality hay cannot be used in such a feeding scheme with the expectation that normal growth will result.

Grass silage for growing dairy heifers

Following the experiments of rearing dairy heifers with good-quality hay with a minimum of grain and milk at Beltsville, we decided to determine whether the same program would work with alfalfa silage. It should be pointed out that the alfalfa silage used was wilted and had no additions of grain, molasses or other preservative.

The results to date have indicated that body weights were about 15 percent below normal at 24 months of age. The addition of one pound of hay per 100 pounds body weight, feeding grain to 12 months of age or feeding 2 or 3 pounds of grain to 24 months of age is helpful in increasing growth to the normal level. Addition of corn silage was of no benefit. We believe the lack of growth is due to a decreased energy intake. Further experiments are now in progress to determine how alfalfa silage can be used with a minimal amount of grain. At this time we feel that feeding as much hay as the heifers will consume or the feeding of 2 or 3 pounds of grain throughout the growing period is necessary to obtain normal growth.

Forage as a source of energy

Where good-quality forage is available, it can supply 65 to 80 percent of the nutrients required for milk production. In some instances where milk production is below 30 pounds per day, good-quality forage can supply all the nutrients necessary to meet the requirements.

It should be remembered, however, that forage is not a high-energy feed and that the indigestible residues in forage, such as lignin, compete for space in the digestive tract and limit the amount of forage that a cow can consume. Therefore, for high-milk production some grains must be fed.

The amounts of hay that must be consumed to meet certain levels of milk production are shown in Table 12. Here it willbe seen that on an energy basis, a 1,000-pound cow producing 50 pounds of milk (4 percent fat corrected milk) cannot consume enough forage to meet her energy requirements. If the forage is of good quality, she would consume enough to produce between 20 and 30 pounds of milk per day.

Table 11 - Growth rate of heifers on hay and corn silage rations 1/

Group and ration fed	Amount of grain fed 2/	Percentage of normal weight at ages indicated			
		6 months	12 months	18 months	24 months
	pounds	percent	percent	percent	percent
Alfalfa and timothy hay plus corn silage:					
Group 1					
4 Holsteins	889	92	103	101	102
4 Jerseys	724	91	100	102	106
Group 2					
4 Holsteins	568	92	97	104	104
5 Jerseys	556	88	93	101	105
Alfalfa hay plus corn silage:					
Group 3					
2 Jerseys	549	102	103	111	111
Brome-ladino or orchard grass-ladino hay plus corn silage:					
Group 4					
2 Jerseys	551	109	105	112	115
Alfalfa and timothy hay plus stalk silage:					
Group 5					
3 Holsteins	563	88	89	93	95
5 Jerseys	553	88	90	95	101
Alfalfa, timothy, and orchard grass-ladino hays:					
Group 6					
2 Holsteins	576	96	105	106	100
5 Jerseys	563	92	100	104	105
Alfalfa hay:					
Group 7					
2 Holsteins	563	98	102	106	100
4 Jerseys	547	94	97	104	101

1/ Colostrum fed for first 3 days to all groups; no milk fed after 60 days of age. Maximum milk fed daily to Holsteins, 9 pounds; to Jerseys, 8 pounds. Total milk fed to Holsteins, 500 pounds; to Jerseys, 450 pounds.

2/ No grain fed to group 1 after 11 or 12 months of age; no grain fed to groups 2 to 7, inclusive, after 8 or 9 months of age.

Table 12 - Amount of good alfalfa hay necessary to meet the requirements of a 1,000-pound cow at various levels of production.

4 percent fat corrected milk	Net energy required	Hay	Total digestible nutrients required	Hay
pounds	therms	pounds	pounds	pounds
20	12.36	29.8	14.41	28.2
30	15.37	37.0	17.65	34.5
40	18.38	44.3	20.89	40.9
50	21.39	51.5	24.13	47.2
60	24.40	58.8	27.37	53.6
70	27.41	66.0	30.61	59.9

NOTE: Requirements for maintenance equal 6.34 Therms, or 7.93 pounds T.D.N. Requirements for 1.0 pound 4 percent fat corrected milk equal 0.301 Therms, or 0.324 pound T.D.N. Good alfalfa hay equals 41.5 Therms, or 51.1 pounds T.D.N. per 100 pounds.

Protein in the grain ration

In some sections of the country where herds are being fed hay or silage made from legumes, as the sole forage, more protein is being fed in the grain ration than is necessary. Under average milk producing conditions, there is little need for feeding a 16 to 20 percent protein grain ration with legume silage or hay. As a matter of fact, simple mixtures of home-grown grains are ample. In any case, with legume silage or good legume hay, the protein content of the ration does not need to be over 10 to 12 percent. Where the silage or hay consists largely of grasses, a 14-percent grain ration is adequate. Also if legume silage or hay is fed along with corn silage, a 14-percent protein grain ration should be adequate.

Summary

1. Good-quality forage is the cheapest source of nutrients for the economical production of milk.

2. It also provides the minerals and vitamins essential to the health and reproduction of the dairy cow.

3. Poor-quality forage is more expensive to produce than good-quality forage.

4. Good-quality forage is consumed in larger quantities than forages of poor quality.

5. The making of grass silage and barn-dried hay is a much superior method of preserving the nutrients and obtaining high-quality forage than field-curing.

6. Dairy cattle can be fed grass silage as the sole forage for milk production, but the feeding of a small allowance of dry hay is advisable.

7. Grass silage properly supplemented is an excellent forage for growing dairy heifers.

8. Less protein can be fed in the grain ration where good-quality forage is used.